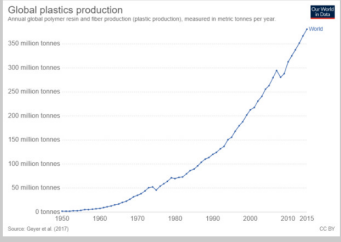
Reducing Marine Debris: Recycled Drainage Nets

Abstract

Our team is extremely passionate about marine biology and saving the environment. We ended up choosing the *An Ounce of Prevention is Worth a Pound of Cure*... because we firmly believe that the best way to stop the pollution of ocean is to stop the pollutant from ever reaching the ocean. Pollution is entirely preventable and we wanted to create an simple and economically efficient method to prevent the further damage to the marine ecosystems. By using a net (manufactured from plastic bags) and an ROV powered by a hydrodynamic battery (powered by the water), we believe our solution can theoretically prevent any type of debris and trash from reaching the ocean, regardless of the climate or weather conditions.

Background and Motivation

In the ocean, there is a staggering 5.25 trillion pieces of plastic debris in the ocean. In the US alone, more than 100 billion plastic bags are used each year. Around the world, untreated sewage flows into coastal waters, carrying organic waste and nutrients that can lead to oxygen depletion, as well as disease-causing bacteria and parasites that require closing beaches and shellfish bed. The plastic debris in the ocean has contributed to the fall of various marine ecosystems, global warming, as well as fatal impacts on the lives of many aquatic creatures. Our team is very passionate about marine biology and environmental awareness, and thus we hope to contribute our part in preserving our wildlife and our planet with our our eco-friendly solution. Our goal for this project is to collect and properly discard of any garbage before it enters the waterways.



Methodology

By utilizing recycled plastic bags to create drainage nets for sewer openings, the issue of ocean pollution can be resolved before the trash reaches the waterways. While drainage nets are already in existence, using recycled plastic bags instead of manufacturing a new product will help the prevalent issue of mass plastic waste, especially on a larger scale. In order to optimize the function of the drainage nets, sensors would be placed near the nets or around the opening that would be able to detect when the net is full and alert the local sanitation department to pick up the trash and replace the net. Furthermore, to reach full efficiency in preventing trash from entering the ocean, a SeaPerch ROV would be installed in the area slightly away from the sewer opening to locate and collect and trash that wasn't caught by the net. This ROV would be able to navigate both shallow and deeper waters, depending on the water level, and it would include a sensor and mechanical arm, as well. Additionally, the ROV would be powered by a hydrodynamic battery charger, making it a low maintenance system with constant energy supply. This hydrodynamic battery charger would generate electricity using the pressure of the water, so external energy would not be necessary for the system to work. All in all, the drainage net along with its sensor and the retrieval ROV combined would create a system to minimize marine debris entering waterways.

Drainage Net

Hydrodynamic Battery Charger

Results & Discussion

Our hydrodynamic battery charger design consists of an orange tub and a pump, which sprays water through a nozzle, mimicking the water pressure coming from the human water cycle. The water pushes the water wheel connected to a 12 volt DC generator, which is changing mechanical energy to electrical energy. This converted energy can be used to power the motors in our SeaPerch ROV that would detect the amount of trash that is in the net and if it must be emptied out. In our prototype, we used snap circuits to light a lightbulb, to test if electricity would be generated from the pressure of water. We also decided to make our idea out of aluminum alloy so that it is lightweight and can spin freely. Based on our calculations, we concluded that generating electricity from the hydrodynamic battery charger would save a lot of money and help power the ROV, allowing for our system to be cost effective and efficient.

While coming up with different designs for our system, we concluded that using recycled trash would be the most effective and environmentally friendly. Nets are generally made out of polyester, nylon, yarns, threads, and other fibers, however these materials are not as environmentally friendly as recycled garbage. Making polyester from plastic would allow for less trash to end up at landfills, which will help the environment. This would also allow for our system to be cost effective, since we do not have to spend money on materials and then replacing the net after it gets worn out and old.

Costing

Material	Amount	Unit Price	Total Cost
Stainless Steel Wheel	.5 kg	$1.5/kg	$.75
Stainless Steel Chassis	.5 kg	$1.5/kg	$.75
Dc Generator	1	$7.00	$7.00
Water Meter	1	$10.00	$10.00
		Total cost =	$18.50

Benefits

Minutes of Water Used every Month	Time To Charge 12v Battery	Unit Battery Price	Number Of Batteries Charged Per Month	Total Saved Per Month
7200 Minutes	480 Minutes	$4.50	15 Batteries	$67.50

Conclusion

To conclude, we wanted to create an low-cost, simple, and efficient method for reducing the amount of debris and trash that enters the ocean. This project was especially fun to do, as we were able to get more experience in both electrical and mechanical engineering, as well as various physics concepts pertaining to force, torque, voltage, pressure, and more. We were able to model a hydrodynamic battery charger to understand the how the pressure of water could create electricity and how this would help, especially during hurricanes, when the power is out for long periods of time. We hope that our solution to combat the waste problem in water by using recycled trash to create a net at the end of sewers to collect trash evolves into something even greater and will have a major impact on the ocean health.

Next Steps

One issue this system may encounter is harsh weather condition in certain areas. As many parts of the country are prone to hurricanes or storms that cause power outages, we decided to implement a hydrodynamic battery charger that can be used instead of an energy source dependent on a power line. However, the effect of these storms on the functionality of the hydrodynamic battery charger is something that cannot be predicted, so testing will be necessary.

For this plan to be most effective, a policy could be put in place that mandates these drainage nets on all sewer openings. Doing this would eliminate the problem of marine debris caused by sewage runoff. Furthermore, for the area that cannot afford labor or installation costs, campaigning and fundraisers can be done to cover these expenses, so that each and every region would have this system to combat ocean pollution.

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Brave Robotics